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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/849,530	05/07/2001	Vincent J. McGahay	FI9-98-172US2	1010

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EXAMINER

MALDONADO, JULIO J

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 12/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/849,530

Applicant(s)

MCGAHAY ET AL.

Examiner

Julio J. Maldonado

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 September 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 15-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 15-18, 20, 21 and 26-30 is/are rejected.
- 7) ☒ Claim(s) 19 and 22-25 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 15, 16 and 26 are rejected under 35 U.S.C. 102(e) as being anticipated by Liu et al. (U.S. 6,143,657).

Liu et al. (Figs.1A-1F) teach a method of forming an adhesive layer on a copper interconnect including providing a germanium-containing layer (22) comprising copper germanide on at least one surface of a copper member (12), by providing germane over the interconnect structure; and providing a layer of a material (20) that does not adhere to copper on the germanium-containing layer (22) (column 2, line 6 – column 4, line 19).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 17, 18, 20, 21 and 27 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. ('657).

In reference to claim 17 Liu et al. teach wherein the germane is at least a temperature of about 200 to about 400°C but fail to teach the germane is flowed at a temperature of about 200 to about 450°C. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use Liu et al. because the range of Liu et al. overlap the range of the claimed invention. See MPEP 2144.05 (“In the case where the claimed ranges “overlap or lie inside the ranges disclosed by the prior art” a *prima facie* case of obviousness exists”).

In reference to claim 18, Liu et al. teach providing a gaseous composition containing germane and helium, but fail to teach the composition containing about 0.05 to about 5% of said mixture. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable the above-mentioned composition range to arrive at the claimed invention.

In reference to claim 20 and 21 and 27, the teachings of Liu et al. substantially teach all aspects of the invention but fail to show the thickness of the germanium-containing layer is about 100 to about 1,000Å thick; and the thickness of the copper member is about 1,000 to about 20,000Å thick. Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it

Art Unit: 2823

appears prima facie that the process would possess utility using another dimension.

Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

5. Claims 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. ('657) in view of the Applicants' Admitted Prior Art.

Liu et al. substantially teach all aspects of the invention but fail to show that the material that does not adhere to copper is either silicon nitride or silicon oxide, wherein the thickness of the silicon nitride layer is about 100 to about 20,000 Å thick. However, the prior art teaches forming a material that does not adhere to a copper member, wherein the material is either silicon nitride or silicon oxide (page 1, lines 14 – 23, and page 2, lines 11 – 12). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the teachings of the prior art and Liu et al. to enable to use silicon nitride and silicon oxide as material layers.

The combine teachings of the Liu et al. and the prior art fail to teach wherein the thickness of the silicon nitride is about 100 to 20,000Å thick. Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose

these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Allowable Subject Matter

6. Claims 19, 22-25 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: Liu et al. (Figs.1A-1F) teach a method of forming an adhesive layer on a copper interconnect including providing a germanium-containing layer (22) comprising copper germanide on at least one surface of a copper member (12), by providing germane over the interconnect structure; and providing a layer of a material (20) that does not adhere to copper on the germanium-containing layer (22) (column 2, line 6 – column 4, line 19).

However, Liu et al. neither teach nor suggest wherein the germanium-containing layer is provided by providing a layer of copper germanide on the copper and then

Art Unit: 2823

oxidizing all or a portion of the copper germanide to provide a layer of germanium oxide; wherein the germanium-containing layer is provided by providing a layer of copper germanide on the copper and then nitridizing all or a portion of the copper germanide to provide a layer of germanium nitride; and wherein the germanium-containing layer is provided by providing a layer of copper germanide on the copper and then oxidizing all or a portion of the copper germanide to provide a layer of germanium oxide, and then nitridizing a portion of the copper oxide to provide a layer of germanium nitride.

Response to Arguments

7. Applicant's arguments filed 09/22/2003 have been fully considered but they are not persuasive.
8. The declaration filed on 09/22/0003 under 37 CFR 1.131 has been considered but is ineffective to overcome the Liu et al. reference because the declaration is not signed.
9. The evidence submitted is insufficient to establish a reduction to practice of the invention in this country or a NAFTA or WTO member country prior to the effective date of the Liu et al. reference. The submitted evidence teaches forming an adhesion layer between a silicon nitride layer and a copper layer to cure adhesion deficiencies between these two layers. However, independent claim 15 is open to form an adhesion layer between a copper and layer other than silicon nitride, such as tungsten or tantalum.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Art Unit: 2823

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

11. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via julio.maldonado@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

Application/Control Number: 09/849,530

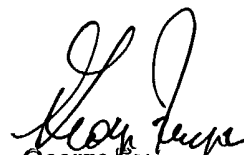
Page 8

Art Unit: 2823



JMR

12/6/03



George Fourson
Primary Examiner